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ABSTRACT

To test how phonemic awareness influences reading, two experiments were conducted in the northwestern part of England in which twenty pairs of children possessing phonemic awareness (pa+) and lacking phonemic awareness (pa-) and matched for reading and chronological age were compared. In the first experiment, the subjects' ability to detect changes in the graphemic structure of isolated words was assessed. In the second experiment, the subjects' reading from their schoolbooks was examined by miscue analysis. In comparison with the pa- group, the pa+ group was significantly more sensitive to changes in grapheme structure and made greater use of graphemic cues and made fewer "nonsense" errors in "normal" reading. (Author/DF)

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The role of phonemic awareness in the reading style of beginning readers.

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ABSTRACT

Phonemic awareness (p.a.) is highly correlated with the reading abilities of young schoolchildren. However, no-one has tested how p.a. influences reading. Two experiments compared 20 pairs of children possessing p.a. (pa+) and lacking p.a. (pa-) matched for reading and chronological age. In Experiment 1, the subjects' ability to detect changes in the graphemic structure of isolated words was assessed. In Experiment 2, the subjects' reading from their schoolbooks was examined by miscue analysis. In comparison with the pa- group, the pa+ group was significantly more sensitive to changes in graphemic structure and made greater use of graphemic cues and make fewer "nonsense" errors in "normal" reading.

Introduction.

This paper attempts to link two previously disparate areas of reading research - reading style and phonemic awareness in beginning readers. Phonemic awareness (p.a.) may be defined as "the conscious realisation that words can be decomposed into discrete units (phonemes) and that words have phonemes in common" (Stuart-Hamilton 1984). It has been known for some years that p.a. is highly correlated with the reading abilities of beginning readers ,(cf. Bradley & Bryant 1978, 1983; Morais et al 1979; Lewcowicz 1980). This was emphasised by Bradley & Bryant (1983) who found that the better a child's p.a. at pre-school level, the better his/her reading ability at 7 years. Explanations of why p.a. and reading ability are related areusually that the acquisition of p.a. reveals the logic of the alphabetic system to the child (cf. Rozin & Gleitman 1977). Put simply, if a child does not know what phonemes are, then s/he cannot know what letters represent. Though s/he may use letters as visual cues in reading (though not efficiently, it is argued) s/he is blind to the logical lynchpin of written English.

This is a plausible argument, but it has never been

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empirically examined. Therefore, I decided to test if p.a. does affect a child's processing of letter (grapheme) information. This was to be done by examining p.a.'s effect on reading style.

"Reading style" is shorthand for any measure of relative reliance on reading sub-skills. A popular measure of this in young readers is miscue analysis, and the best-known study in this field is probably that of Biemiller (1970). Biemiller heard a group of American 1st-graders read at intervals through their first year at school, and recorded any mistakes, or "miscues" that they made. The miscues were then classified into 4 types: (1)insertion (word added which was not in the text); (2)non-response ("N-R", the child stops reading and/or asks what the next word to be read is); (3)omission (a word is "skipped over" with no apparent pause); and (4)substitution (word is misread). The substitution errors were further classified into those which had the same general graphemic structure as the word which should have been read, and which made the same contextual sense as the target word in the text, (graphemic and contextual substitutions); those which only had the same graphemic structure, (pure graphemic substitutions); those which only made contextual sense (pure contextual substitutions); and substitutions which made no sense at all (nonsense substitutions). Biemiller found that initially children's errors were largely contextual substitutions. They then entered a "N-R phase" where over 50% of the errors were N-R miscues. At the same time there was a rise in the number of pure graphemic substitutions. In a third phase, errors were chiefly graphemic and contextual. Cohen (1975) effectively replicated Biemiller's findings. But Dodd (1982) using the same paradigm, did not. Dodd found no evidence for the N-R phase, and pure graphemic substitutions remained constantly low throughout the year. Instead, throughout the year there was a steady rise in the number of contextual and graphemic substitutions. The differences between Dodd's and Biemiller's and Cohen's findings could be due to different subject groups in different education systems (Dodd's subjects were English, the other researchers' were American), or to the low inter-observer reliability in reading style studies (cf. Hood 1976). There is nonetheless an agreement that early reading development is characterised by an increasing dependency on graphemic information from an initial heavy use of contextual information.

Dodd lent further support to this hypothesis in a "posting and matching" task (full details in the Method section of this paper). Dodd gave her subjects the task of sorting through some printed cards for copies of a target word. The pack of cards comprised 3 copies of the target word and 11 graphemically altered versions of it (i.e. some of the letters were changed). Dodd found that with increasing age/reading ability her subjects scored more highly on the task and were able to detect increasingly subtle changes in graphemic structure. Concluding the study, Dodd questioned whether the observed changes were due to an ability to deal with increasingly complex stimuli, or to the "realisation of the importance of letter identity".

Thus, there is evidence for a strong role of graphemic processing in early reading, and it is now time to examine p.a.'s role in these events. To do this, it was decided to compare children's performance on a p.a. test with that on tests of reading style. The p.a. test chosen was one of my own devising. I had earlier found (Stuart-Hamilton ibid) with a sample of 100 infant school children that p.a. test scores correlated with Carver Word Recognition Test scores at r=.79 and with Schonell Spelling Test scores at r=.72 (both sig. at p<.001). To test reading style I used Dodd's measures of miscue analysis and Dodd's posting and matching task. In order to give as clear a picture of the effect of p.a. as possible, it was decided to compare groups with no p.a. (pa-) with groups with high p.a. test score (pa+). To ensure that any differences were not due to differences in reading ability and/or age, the pa+ and pa- subjects were matched for these factors.

Method

Subjects

The subjects were the entire reception classes of four infant schools in the north-west of England, and had been in school 1-1.5 terms when tested. All the children were native English speakers. At the teachers' request, SES data on individual subjects were not recorded. All the schools used an "eclectic" reading teaching system, (i.e. a mixture of phonics and whole word methods). In total, 154 subjects were tested, from whom 20 matched pairs were obtained. Subjects with assessed hearing/speech impediments were excluded.

Materials and procedure.

The tests used were, the Carver Word Recognition Test, (Carver 1970); the two p.a. test of my own devising; Dodd's posting and matching tasks; and the miscue analysis.

The Carver test.

This consists of 50 items; in each item the subject is told a word in isolation and in a high context sentence, and is then required to locate its printed representation from a list of alternatives.

The p.a. test.

The p.a. test was in two sections. The first of these, termed "Input", was in itself in two parts. The first part of the Input section - "Input Rhyme" - required the subject to judge if two spoken words "ended the same". There were two groups of words presented, with five target pairs and five non-target pairs in each, (see Table 1). The target pairs ended the same, whilst the non-targets did not. The full targets have more letters in

common than the half targets. Subjects had been found to be insensitive to this difference in earlier studies. However, to preserve continuity with these, this procedure was continued. The full non-targets had medial letters in common to ensure that the subjects were not making similarity judgements on the medial letters.

The second section of the Input task - "Input Alliteration" - required the subject to judge if two words began with the same sound. Two groups of words were used - full targets coupled with full non-targets, and half targets coupled with half non-targets, (see Tables 1&2). The similarities between the words were identical to those in the input rhyme section, except that they now lay at the start of the word.

The second section of the p.a. test, termed "Output" was also in two parts. The first, "Output Rhyme" required the subject to say a word which "ended the same" as a presented spoken word. Five real CVC words were presented in total; these are listed in Table 2. The second part of the "Output" task, "Output Alliteration" required the subject to say a word which began the same as a spoken example. A list of examples is given in Table 2.

Procedure

The "Input Rhyme" task was introduced to the child by asking if spoken word pair "ended the same" (e.g. "do cat and car end the same?"). This first pair to be presented always consisted of words which ended the same, though not of words which would appear in the test. If the subject said that they did, then further practice items were given. To ensure that the subject was not responding purely to the phrase "the same", amongst these were some pairs which began the same,(e.g.,"cat,car"). If the subject, even after correction, said that three examples of these same-beginning words "ended the same", then a score of zero was given.

Subjects who failed because they were responding purely to a similar sounding word were quite rare (4 of the initial sample). Much commoner was the subject who responded randomly, persistently replied "yes" or "no", or simply expressed incomprehension. Here remedial measures were attampted. Necessarily, the precise procedures differed between subjects, but included were, employment of different terms in explaining the task, the breaking of the task into sub-components,(e.g., asking the subject to identify just the final letter of one word), and working through an example with the subject. If the subject still answered incorrectly, (i.e. was still persistently saying yes or no; or, answered randomly; or, was still telling the experimenter that s/he did not know) then the test was terminated, and the subject received a score of zero.

Following this training phase, the p.a. test proper began. The word pairs in the Input Rhyme task were presented in two counterbalanced blocks. The "Full" group consisted of the full

rhyme and full target pairs,(see Tables 1&2). Within this block, the words were presented randomly. The "Half" block,(the half pairs and the half non-targets) was similarly presented. The aim of this pairing of targets and non-targets was to ensure the subject was not responding to similarities in the medial sounds of the words.

An identical procedure was used in the presentation of the Input Alliteration task, except that the subject was here required to judge if a pair of words "began the same".

The output rhyme task was introduced by asking the subjects to think of a word which "ended the same" as a spoken example. This example was not one of the test items. Should the subjects produce a correct answer, then they were given some more practice examples, and then the test items. Should they respond incorrectly, then explanatory measures were again attempted. These of necessity varied from subject to subject, but included changes of terminology,(e.g.,"finishes" instead of "ends") , attempts to break the test into smaller components,(e.g., to say what letter the word ended with), and working through an example with the subject. (Unlike the Input task, a few subjects responded to this treatment). Subjects who began to respond correctly were treated from then on like subjects who had responded correctly from the first example. If they persistently failed to respond, then this section of the test was terminated, and they were given a score of zero.

The Output Alliteration task was conducted in an identical manner, except that the subject was required to produce a word which "started the same".

Dodd's word recognition ("posting") test. The child was required to judge if various letter strings were the target word or not. Five target words were used - cow, hen, mouse, donkey, and elephant, ("hen" was substituted for "dog" which was used in Dodd's original experiment, because it was suspected that the subjects were reading "dog" as a "sight" word). There were 11 transformations of each target word, and these are listed in Table 3). (The "jumbled" condition replaces a "transformation" condition in Dodd's experiment, which contained meaningless letter strings of the same length as the target). The 11 transformations of each word, plus 5 copies of each target word, were printed in lower case letters separately on 4 by 6" cards, giving fifteen test cards, and one example card for each target word. Each target was dealt with separately.

The test procedure was as follows. The 11 transformation cards were shuffled, and the 4 target cards folded into the pack, with the provisos that two or more were never inserted together, and a target card was not at the top or bottom of the pack. The example of the target, (the fifth card) was placed on top of the pack. A toy postbox, with a picture of the animal concerned, (e.g., if the target word was "cow", a picture of a cow was on the postbox) was put in front of the child. S/he was told that

the task was to decide which cards were to be posted to the animal, and which were not. Only those cards with the animal's name on were to be posted and the reject cards given to the experimenter. The example target card was given to the child, and s/he was told what it said. S/he was then told to look at the card very carefully, and then post it. The subject then worked through the pack of cards. S/he was not allowed to see the target after it had been posted. This was to impose a memory load upon the child so "that the errors would show more clearly the elements of the word that the child was able to pay attention to", (Dodd,1982,p.62). This procedure was used for each of the five target words in turn. The order of presentation of the words was varied using a latin square design.

Dodd's word matching task. The sets of 15 cards in the posting task were used. The subject had to match the cards to a picture of the animal and the target word printed in larger letters than the cards, (to prevent direct matching by word length or size). The 15 cards were distributed as for the word posting task. The subject had to pick out all the cards which gave the animal's name like the bigger printed card. The example card was again used to give the child an idea of the task. In Dodd's task, the target card was then placed in view of the child above the picture. It was decided that this could lead to the child matching by direct visual comparison. Thus, in this experiment, the subject's choices were placed in two face-down piles. The same procedure was adopted for each of the five words. The order of presentation of these words was varied from subject to subject by a latin square design.

Reading style analysis. The measure used here is adapted from Dodd (1982). Each subject read for the experimenter from his/her current reading book on 3 consecutive schooldays. Each child read at least 300 words over this period. Reading was terminated at a suitable point in the story. Errors were recorded in pencil in a copy of the book the child was reading. Any deviation in the child's reading away from the presented text was recorded. These errors were marked and classified into the following types:

(a) Substitutions: where a word was misread. Marked by crossing out the word in the text, and writing the substituted word above it.

(b) Insertions: where a word is added to the text. Marked by entering a caret, (^) at the point of insertion, and writing the inserted word above it.

(c) Omissions: where a word is not read, or is partly read, but is then skipped over, with no discernable break in reading. Marked by crossing out the omitted word.

(d) Non-response: where a word is not read, or is partly read, and instead of "skipping over" it, the subject stops. Dodd's criteria for assessing this were used - i.s., a pause of

at least 10 seconds, or a statement from the child to the effect that they did not know the word. The experimenter supplied the word, and the child was instructed to carry on reading. A non-response was marked by drawing brackets around the word.

Eccentric pronunciations, pauses and repetitions were not recorded. Except in the case of non-responses, the experimenter did not correct the child unless asked to by the child; or if the subject was constantly misreading a word; or if previous errors were leading to confusion. If the child made an error and then corrected him/herself, this was recorded as a self-correction, (marked by writing "s.c." above the word). These were fairly rare, and were not included in the analysis.

The substitution errors were further classified into the following types:

(a) Those that were only contextually acceptable, and bore no graphemic similarity to the stimulus word, (e.g., reading "the white cat" for "the black cat").

(b) Those that were only graphemically acceptable, and made no contextual sense, (e.g., "the cat was blue" for "the cat was big"). A substitution was held to be graphemically similar if it began with the same letter as the stimulus word. This apparently crude measure was devised by Biemiller, who in justification cited Weber's (1970) finding that the first letter mistake was strongly correlated with other graphemic similarities between the substitution and target words. Dodd points out that Weber placed a strong weighting on initial letter correspondence in drawing up her similarity index. However, there are two points in favour of Biemiller's measure. The first is that it is simple, easy to use and unambiguous. The second is that it would seem to be a good measure. In this present study I out of interest also calculated the number of substitution errors which began/ended with the same sound and also the number which ended with the same grapheme. The difference between the scores registered by this more comprehensive measure and Biemiller's are negligable.

(c) Those that were contextually and graphemically acceptable, (e.g., "the brave boy" for "the big boy").

(d) Those errors which were neither graphemically nor contextually acceptable, (e.g., "the pink rhinocerous" for "the grey rhinocerous").

Design

All subjects were tested individually. An assistant first tested the subjects on the Carver and p.a. tests. Subjects were judged as not having p.a. if they scored zero on all sections of both tests. Subjects were held to have p.a. if they scored above zero on an alliteration and a rhyme section of at least one of the two tests, (in fact, all subjects scored on every section of the two tests, with the exception of two, who failed the output

rhyme task). Subjects were then matched, (one with p.a., one without) on the basis of their Carver scores being within two points of each other. These initial pairings also matched very well for chronological age. Pairs were always drawn from the same school. Twenty pairs were drawn from 154 pupils of 4 schools, (1 school provided 6 pairs, another 4, and the other 2 provided 5 each).

The matched pairs were then tested by myself within a week of their pairing. The children were blind tested to avoid possible biasing effects in the reading style analysis. The subjects were tested on four consecutive schooldays, and one day one week later. The first three days were spent on the reading style analysis, and the fourth on the posting task. A week later, they were tested on the matching task. Dodd's tasks always followed the reading style analysis.

Scoring

Scoring on the Carver and p.a. tests was as detailed before. One point was given for each error on the reading style analysis. Each error on Dodd's posting and matching tasks was also given one point. In order to compensate for there being two letter strings for some transformations but not for others, scores for the "single letter string" transformations, (middle doubled, reversal and middle missing) were doubled.

Results

Pairing of subjects. The mean ages of the two groups, (in months) were; pa+, 66.0 (S.D.=2.57); pa-, 66.1 (S.D.=2.38). As far as possible, subjects were paired by sex. There were 9 all-male, 6 all-female, and 5 mixed pairs. The mean scores of the pa+ subjects on the four p.a. sub-tests were; input rhyme, 17.55 (S.D.=2.5); input alliteration, 17.55 (S.D.=1.85); output rhyme, 4.11 (S.D.=0.87); output alliteration, 4.6 (S.D.=0.63). The pa- subjects did, of course, score zero on all these tests. The mean Carver scores of the two groups were; pa+, 17.4 (S.D.=7.76); pa-, 16.4 (S.D.=8.02). This difference was not significant, (paired t test; $t(19)=0.98$, $p>.05$).* In addition, teacher ratings of reading ability were obtained on a scale of 1 to 5, (1=well below average; 2=below average; 3=average; 4=above average; 5=well above average). Pa+ subjects had a mean rating of 3.43, compared with the pa- subjects' 2.83. This was not a significant difference, (paired t test; $t(19)=1.98$, $p>.05$).

Posting and matching tasks. The mean number of non-targets

*According to the Carver scoring tables, these scores give the subjects a reading age of 4:3-4:6. However, Carver's test has not been standardised on this age group. The test was standardised on a group of 7+ year olds, and "reading ages" below this were calculated by extrapolating a straight line back from the test sample's results, (Carver,1970).

incorrectly posted and matched by the two groups are shown in Table 4. A three way ANOVA of the posting task, with factors; group, animal names, and error type, showed highly significant effects of all three factors. There was also a significant name-error type interaction. However, there was no significant interaction between group and error type and/or animal name, (see Table 5). This absence of a group interaction suggests that the pa+ and pa- subjects were using the same strategy to perform the task, but that the p.a.-possessors were far more adept at using it. The patterning of errors was equivalent to that found by Dodd. That is, the longer words were harder than the shorter ones, and reversal errors were especially prevelent in the shorter words. The same pattern of results was found in a three-way ANOVA of the matching task, (see Table 5). Note, however, that the F of the group difference is reduced in the matching task, (from 13.99 in the posting task to 7.21). This suggests that part of the group difference may be due to a mnemonic factor. A small number of errors occurred with targets which were not posted/matched. The pattern of these results was very similar to that of the non-target errors, but their frequency was too low to permit statistical analysis.

The mean errors, collapsed across groups, were for the posting task, 17.33, and for the matching task 7.15. The subjects were tested towards the end of the spring term. The results are roughly comparable to Dodd's subjects' at their second test session in the summer term of their first year, (17.2 and 7.1 respectively). Overall, there would seem to be a high degree of consistency between Dodd's and this study's findings.

Reading style analysis. The mean numbers of words read by the two groups were; pa+, 426 (S.D.=17.8); pa-, 394 (S.D.=21.4). This difference was not significant, (paired t test; $t(19)=0.01$, $p=0.33$). The mean error scores are shown in Table 6. The results were subjected to a 2-way ANOVA, the factors being group and error type. The analysis found a significant group ($F(1,19)=10.66$, $p<.01$)); error type ($F(3,19)=66.23$, $p<.001$); and interaction effects ($F(1,57)=4.05$, $p<.01$). Thus, the pa+ group were not only superior to the pa-group, but also appeared to be adopting a different reading style. Attention was then turned to the substitution errors. There was no significant group difference in the ratio of substitution to total errors, (paired t test; $t(19)=0.42$; $p>.05$). However, there is a significant group difference in the distribution of types of substitution errors, (see Table 7). A two way ANOVA of these results found a significant group difference ($F(3,19)=10.04$, $p<.01$) but no significant difference between error types, ($F(3,19)=2.09$, $p>.05$). However, there was a significant group-error type interaction, ($F(3,57)=3.6$, $p<.025$).

Thus, as for the Dodd tasks, pa+ subjects were superior to pa- subjects. Unlike the Dodd task however, there are interactions. Hence the group difference is probably attributable to the two groups employing different reading styles.

Discussion.

Posting and matching tasks. Dodd questioned whether ability at these tasks reflected "realisation of the importance of letter identity" or the, "ability to cope with an increasing number of letters". This study indicates that p.a., and hence the realisation of what graphemes represent, is the important skill. However, the absence of an interaction suggests that pa+ and pa- subjects are attending to the same aspects of word structure. What are these? One possibility is that the subjects judge the words by what they sound like read out loud. This seems unlikely because all the non-targets very obviously "don't sound right" when read out loud, or are unpronouncable. Neither can the children be attending purely to the visual shape of the words, since although in the longer words the most visually similar transformations are the hardest to detect, in the shorter words the visually dissimilar "reversals" are the most difficult to spot. Thus, the subjects are not adopting a simple phonemic or visual strategy.

The most parsimonious explanation is that subjects look for transformations in individual letters. If subjects are making a letter-by-letter search, then logically, the longer the word, the greater the probability they will miss an alteration. Hence, the observed increased number of errors with word length. However, why the reversal errors in the shorter words? Dodd argues that they reflect a failure to always read from left to right. This might be aided by two factors. (1) Most short words spelt backwards are still pronounceable. (2) In scanning a word letter by letter, the child may scan the word "backwards" as well as "forwards". Scanning backwards, s/he might temporarily forget the left to right rule, and identify the reversal non-target as the target. The probability of this happening is greater in short than long words, since in backwards reading a long word, the child has greater time in which to realise his/her mistake. A pre-school child spends a long time learning that objects s/he sees are the same despite changes in orientation. In learning to read, the child encounters for possibly the first time items, (words) which can only be correctly interpreted in one orientation. Possibly it is the conflict between his/her established perceptual "rules" and the newly-acquired left-to-right rule which causes the reversal errors.

How might the effect of p.a. be explained by this letter search theory? Graphemes are largely meaningless without an awareness of the phonemes they represent. Thus, the acquisition of p.a. should cause the child to become aware of the purpose of graphemic structure. From this, it follows that s/he should also realise the importance of graphemic structure. This could have three effects. (1) Pa+ subjects should realise that any alteration of graphemic structure alters the word, and thus be vigilant in searching for changes. Pa- subjects, lacking this realisation, should be more lax. (2) The pa+ subjects are probably more used to using graphemic cues in reading, and therefore are more familiar with letter-by-letter processing than

pa- subjects. (3) It is possible that pa- subjects might detect a graphemic change, but, because they do not realise its importance, accept the changed word as a close enough resemblance to the target and classify it as such. There is some evidence for this from the verbal protocols of the pa- subjects. Some of them made utterances such as, 'this will do", or, "it's near enough" when posting/matching a non-target.

It would seem from this that whilst pa- subjects can examine words letter by letter, their criterion for word identity is not the grapheme. Thus, an effect of the acquisition of p.a. is to make word identification more stringent. In time, this added stringency should create a more accurate word recognition process.

However p.a. influences sensitivity to graphemic structure it is certainly very effective. The mean error rates for the pa+ group were 4.92/55 for the posting, and 2.73/55 for the matching task, (compared with the pa- groups' figures of 13.95 and 6.37 respectively). The implications of this changed awareness are considerable. Spelling should obviously benefit from this newly-acquired knowledge. If the child realises that every letter of a word has to be correct, then s/he will try for greater accuracy. Reading too should benefit. The child should make fewer errors if his/her judgement of word identity is based upon precise spelling rather than what the word "looks like". This will have a "domino" effect. If the child's word identification strategy gets more efficient, then s/he will read more fluently. If s/he does this, then his/her extraction of meaning will improve. If this improves, then the reader will have more contextual cues at his/her disposal to speed up word recognition, etc, etc. Thus, the effect of the acquisition of p.a. may spread beyond its initial bounds. There is support for this argument from the findings of the studies cited in the Introduction, which showed that p.a. is strongly correlated with reading ability.

Reading style analysis. Given the possible "diluting" of p.a.'s influence in "normal" reading described above, the finding of a group difference in miscues of 8 versus 13% is considerable. (It should be stressed that many of these errors were not "serious" - i.e., normally demanding correction). We shall look briefly at each miscue type, before attempting to create an overall picture of p.a.'s effect upon reading style.

The groups showed little difference in the number of insertion miscues made. It may be suspected that they reflect the loquaciousness of the subject, rather than a reading-specific trait. Nearly all the insertions made contextual sense and probably represented a desire to inject some zest into the story, (it often needed it). Dodd found insertion errors to be prevelant only in initial reading, and attributed them to a desire to "tell a story", coupled with an incomplete concept that printed words tell all of the story, (cf. Ehri, 1979). There was also little difference between groups in the omission miscues. The slightly

higher pa+ group's score may be a side effect of faster reading.

More substantial is the group difference in N-R miscues, which is statistically significant, (t test; $t(19)=2.10$, $p<.05$). Two explanations for the pa- group's larger number of errors spring to mind. (1) That they were unable to make use of the contextual information to have a guess at a word's identity. This is highly unlikely, given the evidence discussed above showing that beginning reading is characterised by use of contextual cues. (2) That pa- subjects could not use graphemic/phonemic cues to "build up" a word, and thus gave up. This may partially explain the N-R miscues. Certainly pa- subjects seem to "build up" fewer words than pa+ subjects. Out of curiosity, I noted down subjects' attempts to verbally build up words. I found that 16/20 pa+ subjects built up, compared with 6/20 pa- subjects. This is not a foolproof measure. Some "building up" could represent false starts of pronunciation, whilst other children may build up silently. Nonetheless, it may be a useful general guide, and it is reasonable to assume that some of the N-R errors may be due to a failure to use graphemic/phonemic skills. However, this cannot be the complete explanation, or we would expect pa+ subjects' N-R errors to be virtually non-existent. The most prosaic explanation is that a N-R miscue is due to the child being unable to read the word by any method at his/her disposal. Pa+ readers make fewer N-R miscues simply because they have more skills.

No evidence was found for Biemiller's N-R phase, (i.e., a child with over 50% N-R miscues) though given that the children were only seen at one point in time, this may not be surprising. However, Biemiller's explanation that N-R is due to a "combat" between graphemic and contextual cues seems unlikely given the evidence presented here. As we have seen, the rise in graphemic skills with p.a. produces a fall, not a rise in N-R miscues.

As we saw above, there is no group difference in the proportion of gross substitution miscues, but there is a significant difference in the distribution of sub-types. Perhaps the easiest way to interpret these results is to divide the substitution miscues into those with some graphemic content, (the pure graphemic and the graphemic and semantic) and those with none, (the pure semantic and meaningless). By this reckoning, the pa+ miscues are 54% graphemic, 46% non-graphemic, and the pa- are 39% graphemic, 61% non-graphemic. The pa- subjects' results seem to reflect their lack of graphemic skills. We have already seen that they lack sensitivity to graphemic change in novel words. We now have evidence that they pay less attention to graphemic structure in normal reading than pa+ subjects. Although the acquisition of p.a. brings with it a shift in graphemic processing, it is interesting to note that the change is not to a reading style totally dominated by it; 50% of pa+ substitutions are non-graphemic. Effects of p.a. may be limited in at least two ways: (1) The pa+ subjects' knowledge of, and ability to utilise, graphemic/phonemic information is not, of course, made perfect by their acquisition of p.a., and they still have to learn the seemingly myriad number of irregular spellings. (2) It is

possible that the children were failing to co-ordinate separate cues, and were judging word identity by individual cues. That is, the children might read some words by what the context dictated, disregarding the graphemic cues, and vice versa. This failure to integrate accords with Biemiller's and Dodd's observations of early reading.

The reading style analysis clearly shows a superior performance by the pa+ subjects, which seems to be derived from better graphemic processing. The groups showed virtually no difference in the "neutral" insertion and omission miscues. That p.a. should influence graphemic processing is of course what we have argued throughout. The results clearly indicate that the group differences in the posting and matching tasks were not task specific, but generalize to normal reading. But the influence of p.a. is not just confined to a general sharpening up of graphemic skills; there are signs that it affects other aspects of reading performance. Most clearly, we can see that pa+ subjects had a lower miscue rate. This was due to superior graphemic skills, as we have seen. However, note that the pa+ subjects also made fewer errors which failed to convey any meaning - that is, N-R and meaningless substitution miscues. Thus, even when misreading, they were less likely to disrupt the "flow" of the story. Furthermore, the fact that they seemed able to process novel words better, should enable pa+ readers to assimilate new words into their vocabularies more easily. Furthermore, if the child can develop the skill of building up new words for him/herself, then s/he should spend more time reading to him/herself, and less time queuing to see the teacher for the meaning of a new word. At the risk of being repetitive, the acquisition of p.a. means that lack of awareness of graphemic/phonemic structure is no longer a problem.

However advantageous p.a.'s acquisition appears from the present evidence, it should be remembered that to all intent and purposes, the pa+ and pa- groups were matched for reading ability by an established reading test and also by teacher ratings. The effects we have observed do not lead to glaringly obvious differences from a casual observation of reading performance. The point to be made here is that although the two groups are ostensibly the same now, in time, the difference in group performance may become very apparent. The results of Bradley & Bryants' studies show very clearly the effects of early acquisition of p.a. It should be noted that many of the pa- subjects made graphemic substitution miscues and built up words. Thus, they must have been employing some kind of graphemic strategy. However, whatever strategy was employed, it was one without insight into phonemic structure. This implies that the behaviour of the pa- readers was in effect being performed by rote. Such findings as this question the usefulness of teaching word attack skills to beginning readers without first ensuring that they know why they are being done. Judging "elephank" to be "near enough" hardly bodes well for phonics teaching.

This study has uncovered several new facets to p.a. We have

seen that it greatly improves graphemic sensitivity, both in letter-by-letter searches of isolated novel words, and in the graphemic processing of "normal" text. We have seen how this in turn, leads to pa+ subjects having a better reading style than pa- subjects. This difference is not only confined to graphemic processing, but also probably generally improves reading. Though these differences are not apparent upon a casual observation, they probably are the first indicators of later, and much more apparent differences. However, the main purpose of this study has been to show not that p.a. is important for reading, (which we have already seen) but <u>how</u> it is important.

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TABLE 1 - NATURE OF INPUT PAIRS IN P.A. TEST

Target pairs

"Full rhyme" - identical vowel and consonant ending (e.g., "bag, wag")

"Half rhyme" - identical consonant ending only (e.g., "fat, cut")

"Full alliteration" - identical vowel and consonant beginning (e.g., "bat, ball")

"Half alliteration" - identical consonant beginning only (e.g. "boy, bag")

Non-Target pairs

"Full non-targets" - only medial vowel in common (e.g. "boy, dog")

Only coupled with "full rhyme" and "full alliteration" pairs.

"Half non-targets" - no letters in common (e.g. "bag, cot")

Only coupled with "half rhyme" and "half alliteration" pairs.

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TABLE 2 - WORDS USED IN THE P.A. TESTS

INPUT					
FULL RHYME	bed, fed	well, bell	lot, pot	but, nut	tub, rub
FULL NON-TARGET	cat, man	ten, leg	cut, run	top, lot	pen, red
HALF RHYME	run, hen	not, but	doll, well	fill, ball	gun, ran
HALF NON-TARGET	leg, box	sad, pin	run, big	cup, red	got, pen
FULL ALLITERATION	bed, bell	cup, cut	box, boy	run, rub	fed, fell
FULL NON-TARGET	cat, man	top, got	hill, big	fun, cup	doll, not
HALF ALLITERATION	bed, bag	lot, lip	fat, fed	bell, big	wall, wet
HALF NON-TARGET	cat, dig	but, sad	bot, tub	cup, big	box, red

OUTPUT					
RHYME	bed	log	pot	fell	gun
ALLITERATION	cut	pen	sat	box	dog

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TABLE 3.- TARGET WORDS AND TRANSORMATIONS OF TARGET WORDS USED IN DODD's POSTING AND MATCHING TASKS

TARGET :	COW	BEN	MOUSE	DONKEY	ELEPHANT
MIDDLE DOUBLED:	COOW	BEEN	MOUOUSE	DONONKEY	ELEPHAPHANT
REVERSAL:	WOC	NEB	ESUOM	YEKNOD	TNAHPELE
MIDDLE MISSING:	CW	BN	MSE	DOEY	ELANT
END LETTER DIFFERENT:	COM COP	BEC BEP	MOUSN MOUST	DONKEG DONKEW	ELEPHANK ELEPHANS
INITIAL DIFFERENT:	MOW DOW	FEN CEN	COUSE BOUSE	LONKEY SONKEY	OLEPHANT BLEPHANT
INITIAL ONLY SAME:	CUM CUG	BUW BUK	MARIN MANTY	DISBUG DISCAR	EBOGFICK ECOSONIC
JUMBLED:	WCO OCW	NBE ENB	OSMUE SUMEO	DEGNOK KNODEY	PHENATLE PETHLANE

NOTES:

a. All transformations cue intentially non-words

b. The difference between the two words in the presence or absence of an ascender for the changed letter. The first word in each category has a form similar to the target, the second word the opposite.

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TABLE 4(i) - MEAN NUMBER OF NON-TARGETS INCORRECTLY POSTED AND MATCHED BY Pa+ and Pa- GROUPS (WITH STANDARD DEVIATIONS*, CLASSIFIED BY TYPE OF TRANSFORMATION **

		Middle Doubled	Reversal	Middle Missing	End Different	Initial Different	Initial Only Same	Jumbled
POSTING TASK (Error scores/10)	Pa+	1.45 (1.27)	0.75 (1.06)	0.45 (1.09)	1.1 (1.14)	0.17 (0.4)	0.5 (0.93)	0.5 (0.45)
	Pa-	2.55 (1.39)	2.45 (2.03)	1.25 (1.4)	2.4 (1.63)	1.4 (1.5)	1.6 (1.69)	2.22 (1.72)
MATCHING TASK (Error scores/10)	Pa+	1.2 (1.05)	0.45 (0.68)	0.05 (0.22)	0.65 (0.77)	0.15 (0.28)	0.05 (0.15)	0.2 (0.37)
	Pa-	1.7 (1.41)	1.17 (1.16)	0.5 (0.94)	1.05 (0.93)	0.7 (0.75)	0.42 (0.63)	0.62 (0.87)

* In brackets
** See text

TABLE 4(ii) - MEAN NUMBER OF NON-TARGETS INCORRECTLY POSTED OR MATCHED BY Pa+ AND Pa- GROUPS, WITH STANDARD DEVIATIONS* CLASSIFIED BY ANIMAL NAME**

		COW	HEN	MOUSE	DONKEY	ELEPHANT
POSTING TASK (Error scores/11)	Pa+	0.6 (1.14)	0.7 (0,95)	0.95 (1.08)	1.42 (1.37)	1.25 (0.8)
	Pa-	2.82 (2.22)	2,42 (2,15)	2.52 (1.8)	3.12 (2.41)	3.07 (3.07)
MATCHING TASK (Error scores/11)	Pa+	0.35 (0.58)	0.12 (0,39)	0.72 (0.73)	0.72 (0.73)	0.82 (0.69)
	Pa-	1.12 (1.56)	0,75 (1,16)	1.25 (1.29)	1.43 (1.41)	1.82 (1.43)

* In brackets
** See text

TABLE 5 3-WAY ANOVA RESULTS WITH FACTORS POSSESSION/NON-POSSESSION OF P.A., TYPE OF TRANSFORMATION AND ANIMAL NAME, FOR POSTING AND MATCHING TASKS

	Source of Variance	d.f.	m.s.	F	P
POSTING	pa+/pa- ("A")	1	99.9	13.99	.0006
	animal ("B")	4	2.12	5.26	.0005
	A x B	4	0.40	0.98	.4188
	transformation ("C")	6	6.18	12.13	<.0000
	A x C	6	0.91	1.78	.1042
	B x C	24	0.78	2.27	.0005
	A x B x C	24	0.44	1.29	.1612
MATCHING	pa+/pa- ("A")	1	14.2	7.21	.0107
	animal ("B")	4	2.21	6.92	<.0000
	A x B	4	0.17	0.52	.7237
	transformation ("C")	6	5.17	17.18	<.0000
	A x C	6	0.23	0.76	.6051
	B x C	24	1.27	4.62	.0000
	A x B x C	24	0.31	1.13	.3001

TABLE 6 - MEAN ERROR SCORES OF Pa+ and Pa- GROUPS IN MISCUE ANALYSIS, WITH STANDARD DEVIATIONS *

	MEAN NO. WORDS READ	SUBSTITUTION	INSERTION	OMMISSION	NON-RESPONSE
Pa+	426 (17.8)	19.25 (6.75)	2.35 (2.92)	4.1 (7.07)	5.4 (4.22)
Pa-	394 (21.4)	29.75 (14.25)	2.9 (4.01)	3.6 (6.81)	9.95 (9.38)

* In brackets

TABLE 7 -- MEAN NUMBER OF SUB-TYPES OF SUBSTITUTION ERROR BY Pa+ and Pa- GROUPS WITH STANDARD DEVIATIONS*

	Total No. Substitution Miscues	Pure Graphemic	Pure Semantic	Graphemic & Semantic	Nonsense
Pa+	19.25 (6.75)	5.5 (3.17)	4.4 (2.41)	4.85 (3.73)	4.5 (3.01)
Pa-	29.75 (14.25)	6.6 (5.54)	10.3 (7.63)	5.05 (5.18)	8.3 (4.21)

* In brackets.